Claims.

1. A transmitter apparatus comprising one or more lasers, modulation means to intensity modulate radiation output by each of said one or more lasers, and output means for outputting the modulated radiation produced by the modulation means characterised in that the apparatus comprises hollow core optical waveguides formed in a substrate which, in use, guide radiation from the one or more lasers to the modulation means and from the modulation means to the output means.

2. An apparatus according to any preceding claim wherein at least one of the one or more lasers and the modulation means is a discrete component.

3. An apparatus according to claim 2 wherein said discrete component is located in an alignment slot formed in the substrate.

4. An apparatus according to any preceding claim wherein at least one of the one or more lasers and the modulation means is a monolithic component formed in the substrate.

5. An apparatus according to any preceding claim wherein the output means is arranged to couple the modulated radiation into at least one output optical fibre.

6. An apparatus according to claim 5 wherein the output means comprises at least one fibre attachment means.

7. An apparatus according to claim 6 wherein at least one optical fibre attachment means is arranged to receive a lensed output optical fibre.

8. An apparatus according to claims 6 wherein at least one optical fibre attachment means comprises a mode matching means.

9. An apparatus according to any preceding claim comprising one laser.

10. An apparatus according to any one of claims 1 to 8 and comprising a plurality of lasers.

11. An apparatus according to claim 10 wherein each of said plurality of lasers have a different output wavelength.

12. An apparatus according to claim 11 wherein beam combining means are additionally provided to combine the plurality of modulated beams into a combined beam wherein said output means is arranged to couple the combined beam into a single output optical fibre.

13. An apparatus according to any of claims 10 to 11 wherein said output means is arranged to couple each of said plurality of modulated beams into one of a plurality of output optical fibres.

14. An apparatus according to any preceding claim wherein one of said one or more lasers is a semiconductor laser.

15. An apparatus according to claim 14 wherein said semiconductor laser is a wavelength tuneable semiconductor laser.

16. An apparatus according to any preceding claim wherein one or more detectors are provided to monitor the intensity of radiation output by said one or more lasers.

17. An apparatus according to any preceding claim and further comprising at least one optical isolator.

18. An apparatus according to any preceding claim wherein one or more beam shaping means are provided.

19. An apparatus according to claim 18 wherein at least one of said beam shaping means comprise one or more lenses.

20. An apparatus according to any one of claims 18 to 19 wherein at least one of said beam shaping means comprises a tapered hollow core optical waveguide.

21. An apparatus according to any preceding claim wherein said modulation means comprises one or more electro-optic modulators.

22. A transmitter apparatus comprising at least one laser capable of producing intensity modulated radiation and output means for coupling the radiation produced by the laser into at least one output optical fibre characterised in that the apparatus comprises hollow core optical waveguides formed in a substrate which, in use, guide radiation from the at least one laser to the at least one optical fibre.

23. A receiver apparatus comprising one or more detectors and one or more optical fibre attachment means, the one or more optical fibre attachment means being arranged to receive one or more one optical fibres, characterised in that radiation is guided from the one or more optical fibres to the one or more detectors by at least one hollow core optical waveguide formed in a substrate.

24. An apparatus according to claim 23 comprising a plurality of detectors.

25. An apparatus according to claim 24 wherein a plurality of optical fibre attachment means are provided to receive a plurality of optical fibres.

26. An apparatus according to claim 25 wherein, in use, radiation from each of said plurality of optical fibres is guided to one of the plurality of detectors.

27. An apparatus according to claims 24 wherein one optical fibre attachment means is provided, said optical fibre attachment means being arranged to receive one optical fibre carrying radiation comprising a plurality of different wavelength channels.

28. An apparatus according to claim 27 and further comprising wavelength demultiplexing means, said wavelength demultiplexing means being arranged to separate said different wavelength channels and to direct each wavelength channel to one of the plurality of detectors.

29. An apparatus according to any one of claims 23 to 28 and further comprising at least one variable optical attenuator arranged to provide controllable attenuation of the radiation received from said at least one optical fibre.

30. An apparatus according to any one of claims 23 to 29 and further comprising at least one wavelength selective filter.

31. An apparatus according to any one of claims 23 to 30 wherein at least one optical fibre attachment means comprises a mode matching means.

32. An apparatus according to any one of claims 23 to 31 wherein at least one optical fibre attachment means is arranged to receive a lensed optical fibre.

33. An transmit/receive apparatus comprising transmitter apparatus as claimed in any one of claim 1 to 22 and receiver apparatus as claimed in any one of claims 23 to 32.

34. Apparatus according to claim 33 wherein said transmitter apparatus and said receiver apparatus are formed on a common substrate.

35. An apparatus according to any preceding claim wherein the substrate comprises semiconductor material.

36. An apparatus according to claim 35 wherein the substrate comprises a silicon on insulator (SOI) wafer.

37. An apparatus according to any preceding claim formed by micro-fabrication techniques.

38. An apparatus according to claim 37 wherein the micro-fabrication technique includes deep reactive ion etching.

39. An apparatus according to any preceding claim wherein the hollow core optical waveguides are of substantially rectangular cross section.

40. An apparatus according to any preceding claim wherein the hollow core optical waveguides are dimensioned to preferably guide radiation propagating in the fundamental mode.

41. An apparatus according to any one of claims 1 to 39 wherein the hollow core optical waveguides are dimensioned to preferably guide radiation propagating in multiple optical modes.

42. An apparatus according to any preceding claim wherein the internal surfaces of the hollow core optical waveguides carry a reflective coating.

43. An apparatus according to any preceding claim wherein the substrate comprises a base portion and a lid portion.

44. A transmitter module as substantially herein described with reference to figure 1 and 3.

45. A receiver module as substantially herein described with reference to figures 2 and 3.

46. A transmitter/receiver module as substantially herein described with reference to figure 4.